

High Resolution Imaging of Spectral Impedance

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Recent work by several research groups has demonstrated electrical resistance tomography (ERT) -- inversion of electrical resistance to image electrical resistivity and the technology has even been developed for using ERT to monitor various subsurface processes such as steam floods. We have generalized the method to electrical impedance tomography (EIT), including effects of phase differences between the received voltage and the transmitted current (induced polarization) in the inverse scheme.

This paper will report on the early testing of both data acquisition and inverse modeling for EIT. The first tests are conducted on a network of resistors and capacitors of known values while the second set of tests are conducted on a physical scale model in a water tank. For each test both magnitude and phase of the voltages are measured at several frequencies from 1 Hz to 512 Hz and this is the spectral IP data for inversion. The inversion algorithm is based on a generalization of a resistance inverse code to account for reactance as well as resistance in the four electrode voltage and current data.

Inversions on the resistor-capacitor network clearly image the resistance distribution in the impedance magnitude tomograph while capacitive reactance in the network is imaged in both the magnitude and phase tomographs. Similar results were obtained from the modeling tank. Our plans are to test the method next at field sites under controlled conditions.

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